Use of Heater Tapes for Bake-outs

Before beginning a chamber bake-out, notify the Building Manager and ESH Coordinator of when the bakeout will take place. This ensures that they are available for assistance as needed. If you have any questions or need assistance ask for help first.

The preferred configuration for use of heater tapes is as follows:

GFCI dongle - Variac - extension cord - heat tape

Bakeout procedure
1. Prepare signs that alert other workers to the presence of high temperatures, the baked out items can reach 250 °C. Position barricades to prevent people from getting near the chamber. This is especially important in shared spaces where multiple groups may have access to the same space.
2. Be sure to follow heater tape manufacturer’s instructions. Wrap heater tape on chambers such that they do not overlap. The excessive temperatures of overlapped heater tapes can result in premature failure of the heater tape. Label the heater tape indicating which portion of the chamber the heater tape is heating.
3. Secure thermocouples (at least one per length of heater tape) to the bare metal of the chamber near a heater tape and label to indicate which heater tape the thermocouple is monitoring. If more heater tape is added, avoid covering the thermocouple probe with the heater tape.
4. Attach an extension cord to each heater tape plug and label to indicate the heater tape that the extension cord is supplying power to and the section of the chamber being heated.
5. With heater tape attached, wrap the chamber tightly with aluminum foil to improve the efficiency of the heater tape and to prevent fiberglass particulates from spreading.

Steps:
1. Plug each extension cord into a Variac and label the Variac to indicate which heater tape and section of the chamber (to be baked) the Variac is controlling.
2. Plug the thermocouple into a thermocouple reader and label the reader and place it near the associated Variac if possible.
3. Plug five or less Variacs into the 15A power strips attaching a GFCI unit to each of the Variac cables. Ensure dials on each Variac are turned down to zero (0).
4. The GFCI unit is then plugged into the power strip. (The heater tape/Variac setup should draw less than 2.5A each. The total draw on the power strip will be less than 13A. No more than one power strip should be plugged into any one wall circuit because the wall circuit is on a 20A breaker.)
5. Plug the power strip in and turn it on.
6. Ramp up the power to the heater tape slowly using the Variacs. Using the thermocouple readers, monitor and record the temperatures of the areas being heated every 10-15 minutes while ramping up.

NOTE: If any adjustments to the hardware need to be made, power must be disconnected from the heater tape that will be handled.

7. When the temperature of the chamber reaches the temperature desired for bakeout purposes, the Variacs may need to be dialed back slightly. Once the temperature has stabilized, continue monitoring and recording the thermocouple readings at 20-30 minute intervals (unless otherwise directed) making slight adjustments to the Variac output as needed.

Troubleshooting
1. In the event that one of the GFCI units trips, turn the Variac dial to 0 and turn the power to the Variac off. Reset the GFCI unit and try to turn the Variac back on, slowly returning the dial to the position where it failed. If the GFCI unit fails again, repeat the process, but replace the Variac and start the ramping process again for that unit.
2. If the power strip trips off, you may need to remove a Variac-to-heater tape circuit and plug it in to another power strip provided you do not exceed 5 Variacs on any one 15A power strip. A tripped power strip may indicate a short circuit in one of the heater tapes which could be difficult to replace if the chamber has been heated. Ask the person in charge of the bakeout before letting the parts being baked cool down to replace a heater tape.
3. If the wall circuit breaker trips, reduce the number of Variacs being run on the wall circuit. Notify the Building Manager of the tripped circuit and they will have the circuit breaker reset.

All Variacs must be NRTL registered or inspected at SLAC as part of EEIP. If you absolutely need to use a power strip then a procedure or JSA should be used to control the noncompliant configuration during the bake out. The procedure/JSA can address the electrical safety aspects of the bake out:

- Power strip and extension cord sizing
- Ground fault protection/GFCIs
- Maximum loading of the branch circuits and power strips/extension cords
- Actions to take if GFCI or breaker trips
- Grounding of equipment under bake out
- Inspection of devices including the heat tape for damage before use
- Follow heat tape manufacturer instructions (may not allow an extension cord)
- Do not overlap heat tape
- Temperature control and monitoring for overheating
- Use signs or barricades to keep workers at a safe distance
- Unplug the dongle or extension cord before making changes or adjustments

This JSA needs to be approved by the Electrical Safety Officer for SLAC as well as the ESH Coordinator.